No. 685,359. Patented Oct. 29, 1901.

H. H. VAUGHAN.

PNEUMATIC HAMMER AND RIVETER.

(Application filed Feb. 1, 1901.)

(No Model.)

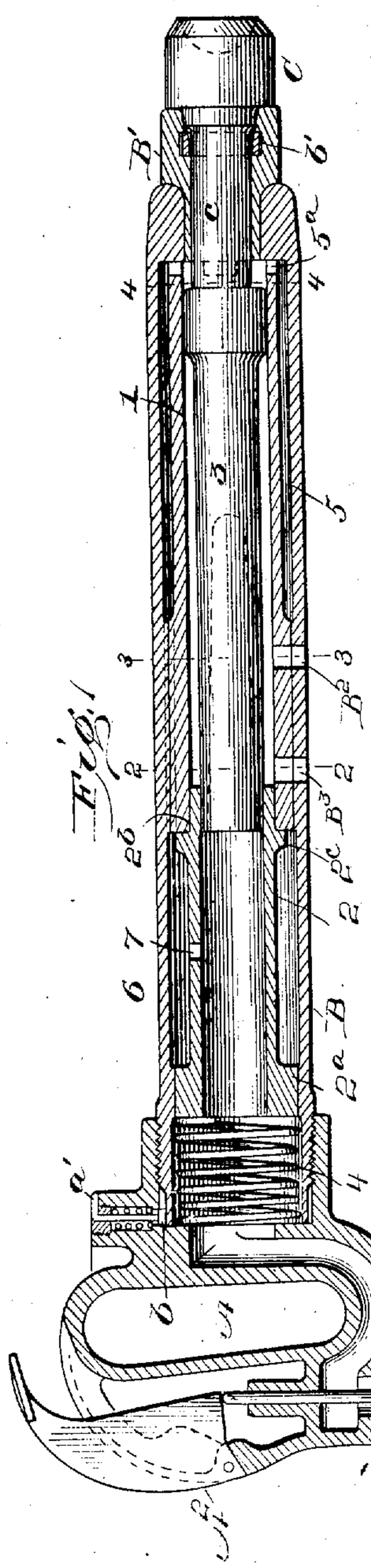

Fig. 1.

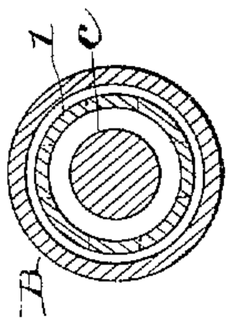

Fig. 4.

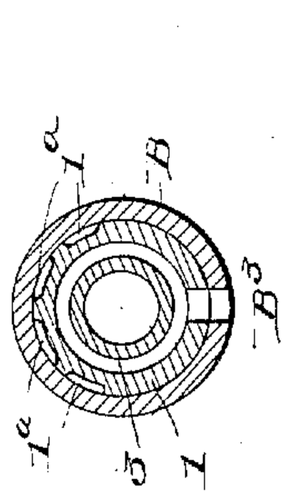

Fig. 2.

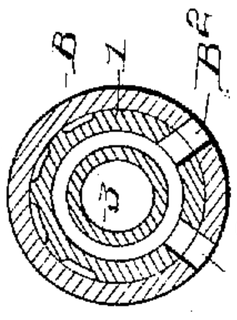

Fig. 3.

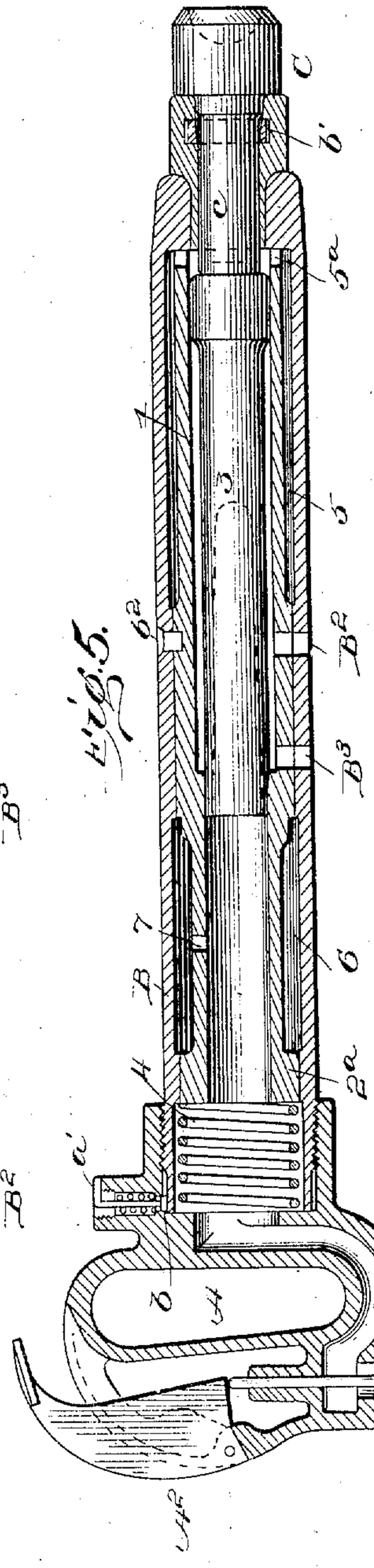

Fig. 5.

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UNITED STATES PATENT OFFICE.

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PNEUMATIC HAMMER AND RIVETER.

SPECIFICATION forming part of Letters Patent No. 685,359, dated October 29, 1901.

Application filed February 1, 1901. Serial No. 45,608. (No model.)

To all whom it may concern:

Be it known that I, HENRY H. VAUGHAN, a citizen of the United States, residing at Chicago, in the county of Cook, State of Illinois, have invented certain new and useful Improvements in Pneumatic Hammers and Riveters; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal central section of a pneumatic hammer or riveter embodying my invention in the preferred form. Figs. 2, 3, and 4 are cross-sectional views taken on the dotted lines 2 2, 3 3, and 4 4, respectively, of Fig. 1. Fig. 5 is a longitudinal central section of a modification wherein the sleeve and bushing which form the clearance-space of the cylinder are made integral instead of separable, as shown in the preferred construction, Fig. 1.

Like symbols refer to like parts wherever they occur.

My invention relates to the construction of that class of devices known as "motive-fluid" or "pneumatic" hammers or riveters, and more especially to that class wherein a differential piston is used and constant pressure maintained upon that head of the piston (or hammer) having the lesser area.

The main object of my present invention is to obtain such clearance volume at the exhaust or lower end of the cylinder as shall insure substantially atmospheric pressure beneath the piston at the point compression commences during the reverse stroke of the piston without increasing the diameter of the cylinder or lengthening the front end of the piston, both of which are objectionable in what are commonly termed "hand-hammers" or "riveters."

To this end one feature of my invention consists in combining with the cylinder of a constant-pressure pneumatic hammer or riveter an inserted sleeve and bushing (which may be integral or separable) channeled on the periphery to form a clearance-space within the walls of the cylinder, said sleeve having a port through which pressure is admitted to the under side of the piston by way of said clearance-space.

In order to facilitate the construction of the device, the sleeve and bushing are preferably made separable, and as when so constructed the sleeve may be driven back or away from the bushing by any extreme movement of the piston said sleeve is given a movable, though substantially air-tight, fit with relation to the cylinder and bushing, so that the fluid-pressure when on will always maintain the proper relation of sleeve and bushing and preserve the normal stroke or movement of the piston or hammer, and such a construction embodies a second feature of my invention.

Where, as preferred, the inserted bushing and sleeve are separable, I prefer to combine therewith and with the cylinder a spring or equivalent means for maintaining the relation of the sleeve to the bushing when the motive fluid is withdrawn, and such a construction or combination embodies a third feature of my invention.

In order to increase the striking velocity of the piston or hammer and reduce its weight, I combine with a constant-pressure pneumatic-hammer cylinder having a clearance-space within its walls, which space has a pressure-port leading thereto, a piston having a cavity or of cup form and devoid of through-ports, and such a construction embodies a fourth feature of my invention.

There are other minor features of invention, all as will hereinafter more fully appear.

I will now proceed to describe my invention more fully, so that others skilled in the art to which it appertains may apply the same.

In the drawings, A indicates the handle of a pneumatic riveter, provided with the usual motive-fluid-supply passage *a*, leading to one end of the cylinder, said passage guarded by the spring-closed valve A′, which valve is operated by lever A^2 to control the admission of the motive fluid to the cylinder.

B indicates the cylinder, which may be screwed into the handle A and may be provided with a ratchet device *b*, with which a dog or catch *a′* in the handle engages to lock the parts securely together.

The handle A, it will be noted, closes the upper end of cylinder B or that end through which the motive-fluid pressure is admitted, and the opposite end of the cylinder B is provided with a ferrule B′, having a suitable

catch b' for holding the removable "snap" or rivet-die C, so that when the rivet-die C or snap is in position it and the ferrule B' constitute the other head of the cylinder. The snap or rivet-die C has a stem *c*, which projects into the cylinder and is struck by the piston (or hammer) when it delivers its down stroke or blow.

To the extent thus far specified the construction may be such as here chosen for purposes of illustration or of any other approved form for constant-pressure hammers.

Inserted within the cylinder and constituting the chamber wherein the piston 3 (or hammer) reciprocates are a bushing 1 and sleeve 2, extending substantially the working length of the cylinder, and said parts may be integral, if desired, (see Fig. 5,) but are preferably separable, and, if separable, the bushing 1 may be pressed or driven into cylinder B, so as to retain its position therein, especially against rotation, while the sleeve 2 may have a movable or sliding, though substantially air-tight, fit, so as to be forced forward by the fluid-pressure in case it should be driven back (toward the handle A) by excessive travel of the piston 3 on its reverse movement, and as a means of holding said sleeve to its seat when the fluid-pressure is withdrawn a coiled spring or equivalent device 4 may be interposed between the free end of said sleeve 2 and the head of the cylinder or the handle A, which constitutes said cylinder-head.

If the sleeve 1 and bushing 2 are formed integral or as a single piece, (see Fig. 5,) in which case said part should be removably fitted into the cylinder B, (and, if desired, may be spring-pressed, as shown in Fig. 1,) a dowel-pin b^2 or equivalent provision should be made to prevent any rotary movement of the parts 1 and 2 within the cylinder B in order that the ports which extend through the bushing may always register with those in the outer shell or cylinder B.

Whether separately formed or integral that portion of the cylinder-lining which has been termed "bushing" 1 will at its upper part or part corresponding to the middle of cylinder B be provided with a series of longitudinal grooves or channels 1^a and below said central section may be of reduced external diameter, so as to form an annular channel or clearance-chamber 5, (see Figs. 1 and 4,) which communicates with the piston-chamber below by ports 5^a or in other suitable manner. While this clearance-chamber 5 within the walls of the cylinder is shown as an annular chamber, it need not necessarily be of such form; but whatever its form it should have a clearance volume equal to at least twenty-five (25%) per cent. of the volume of that portion of the cylinder in which the lower head of the piston acts, or, in other words, a clearance volume equal to at least twenty-five (25%) per cent. of the displacement of the piston during one stroke. Opposite that portion of bushing 1 having the longitudinal peripheral grooves or channels 1^a are a series of ports which extend through the walls of the bushing and when the bushing is in proper position within the cylinder B register with the ports B^2 and B^3 of said cylinder, the first of said ports B^2 B^2 being exhaust-ports, while that marked B^3 is simply a provision to relieve any possible pressure on the piston during the reverse movement and after the ports B^2 have been covered.

The sleeve or that portion of the cylinder-lining which has been termed the "sleeve" 2 will be formed at its upper end of a diameter suitable for its support within the cylinder B, (or with what may be termed a "collar" 2^a,) and if made separate from the bushing 1 will also be reduced at its inner end, as at 2^b, so as to enter the bushing to a limited extent or until arrested by the shoulder 2^c, which will determine the relation of the separable parts 1 and 2.

The reduction of the external diameter of the sleeve-section 2 forms an annular chamber 6, which communicates with the clearance-chamber 5 through the longitudinal channels or passages 1^a and with the interior of the cylinder about midway of sleeve-section 2 by means of a pressure-port 7, which establishes direct communication with the constant-pressure chamber of the cylinder and is the supply-port for the opposite end of the cylinder B, there being no ports or passages through the piston 3.

It will be noted that the internal diameter of the bushing-section 1 and the sleeve-section are different, that of the bushing being the greater, so as to call for a differential piston 3, presenting a lesser area to the constant-pressure chamber, or that end of the cylinder where the fluid-pressure is admitted, and a greater area on the striking end of the piston or hammer or the exhaust end of the cylinder. Where a solid piston or plunger is employed its blow will be the same as the energy back of the piston, and in carrying out my invention I hollow out the piston, as indicated by the dotted lines in Fig. 1, which will increase its velocity and augment its blow, as the energy of the blow is proportionate to the weight occupied by the square of the velocity. There are no ports or passages through the piston, which is thus distinguished from somewhat similar shaped pistons which have supply or exhaust ports therein or therethrough.

The construction being substantially such as hereinbefore pointed out, the devices will operate as follows: The hammer or piston 3 being in the position shown in Fig. 1 of the drawings—that is to say, in the position it occupies when its blow has been delivered on the stem of snap C—and there being a constant pressure of the motive fluid on the upper or lesser area of piston 3, the motive fluid will pass through port 7 of sleeve 2, thence through channels 1^a of bushing 1 into clearance-chamber 5, and through ports 5^a to

the opposite end or under side of the piston or that head having the greater area, and will force the piston back until it shall have passed the exhaust-ports B^2, before which time the upper end of the piston 3 will have covered the supply-port 7 of sleeve 2, and the further return movement of the hammer or piston is due to the expansion of the motive fluid. The instant the piston 3 in its upward or return movement uncovers the ports B^2 B^2 the exhaust occurs, and owing to the increased clearance volume secured by reason of the annular chamber 5 within the walls of the cylinder B and formed by the bushing 1, which clearance-space is also measurably augmented by the annular chamber 6 around the sleeve 2, the pressure on the lower end of the piston 3 is reduced to substantially atmospheric pressure at the point compression subsequently commences.

A great value of the movable sleeve 2, in combination with cylinder and a differential piston, is that it permits the introduction of the piston from the handle end or back end of the cylinder, and thus avoids the formation of an extra joint at the front end of the cylinder or under side of the piston.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a motive-fluid hammer or riveter, having a differential piston and provision for maintaining constant pressure on the head of said piston having the lesser area, the combination with said piston of a cylinder having within its walls a clearance-chamber which communicates with the interior of the cylinder on the side of the piston-head having the greater area, means for admitting pressure to the under side of the piston, and an exhaust-port in said cylinder, substantially as and for the purposes specified.

2. In a motive-fluid hammer or riveter, having a differential piston and provision for maintaining constant pressure upon that head of the piston having the lesser area, the combination with said piston of a cylinder having a detachable lining channeled on its periphery to form a clearance-chamber which communicates with the cylinder and provided with ports which communicate with the cylinder at its opposite ends, substantially as and for the purposes specified.

3. In a motive-fluid hammer or riveter having a differential piston, the combination with said piston of a cylinder having a clearance-chamber within its walls, and a movable sleeve in that portion of the cylinder which contains the head of the piston having the lesser area said sleeve provided with a port, substantially as and for the purposes specified.

4. In a motive-fluid hammer or riveter, having a differential piston, the combination with said piston of a cylinder having a clearance-chamber within its walls, an inserted movable sleeve or lining section, and means for maintaining the lining or sleeve in position when the motive-fluid pressure is withdrawn, substantially as and for the purposes specified.

5. In a motive-fluid hammer or riveter, the combination of a differential piston, a cylinder and a movable sleeve or lining section within that portion of the cylinder which contains the lesser head of the piston, substantially as and for the purposes specified.

6. In a motive-fluid hammer or riveter, the combination with a cylinder and piston, of an inserted movable lining-section for the cylinder and means for maintaining constant motive-fluid pressure upon one head of the piston and on the end of the inserted sleeve which surrounds said piston-head, substantially as and for the purposes specified.

7. In a constant-pressure motive-fluid hammer or riveter, the combination of a hollow or tubular differential piston devoid of ports therethrough, and a cylinder having a clearance-chamber within its walls, an exhaust-port and suitable supply-ports between the opposite ends of said clearance-chamber and the cylinder, substantially as and for the purposes specified.

8. In a motive-fluid hammer or riveter, the combination with a suitable cylinder, of a hollow or tubular differential piston devoid of ports therethrough, and suitable port formations for admitting motive-fluid pressure to the under side of said piston, substantially as and for the purposes specified.

9. In a motive-fluid hammer or riveter, having a differential piston and provision for maintaining constant pressure on the head of the piston having the lesser area, the combination with said piston of a cylinder having within its walls a clearance-space which communicates with that end of the cylinder which contains the greater head of the piston, said clearance-space between the cut-off point on the piston and the ports which open into the lower end of the cylinder having a clearance volume equal to at least twenty-five per cent. of the displacement of the greater head of the piston during one stroke, substantially as and for the purposes specified.

In testimony whereof I affix my signature, in presence of two witnesses, this 17th day of January, 1901.

HENRY H. VAUGHAN.

Witnesses:
FRED KIRGIS,
WALTER SCHUMECKE.